WORLD MARITIME UNIVERSITY

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IMPROVEMENT OF WERCKS REMOVAL MECHNISM IN INLAND WATERS OF CHINA: A CASE STUDY ON THE YANGTZE RIVER

By

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DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of Research Paper: **Improvement of wrecks removal mechanism in inland waters of China: A case study on the Yangtze River**

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The inland waters are important channels for inland, coastal and international transportation of goods in China. With the development of shipping in inland waters, there exist many wrecks in the waterway, which is an important factor jeopardizing the navigation safety and environment protection, affecting the smooth flow of ship, and restricting inland economic development afterwards. In this paper, the Yangtze River, the most representative inland river in China, is taken as the study case. On the basis of the data collecting and analyzing, this paper describes the status of the wreck removal in inland waters, and analyzes the relationship between the relevant subjects.

There are several laws and regulations on wrecks removal in China, but the entire legal system has many drawbacks. Several problems are presented in the paper: responsible subjects differ in diverse laws and regulations, the costs cannot be guaranteed, the salvage market is facing trouble, local governments aren't involved in, etc. But meanwhile, the coming into force of the Nairobi Convention and other changes create a sound external environment for the improvement of the mechanism. Through the SWOT and AHP, it is suggested that the WO strategy should be selected to improve the mechanism. A structure of regulations is proposed in accordance with the analysis, which defines the responsibilities and obligations, guarantees the costs in all aspects, and aims to protect the inland water environment as well as the navigation safety. It is expected that the construction could provide support for the development of inland shipping of China.

KEYWORDS: wreck removal, inland waters, mechanism, Yangtze River

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LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
CLC	International Convention on Civil Liability for Oil Pollution Damage
P.R.C.	People's Republic of China
P&I	Protection and Indemnity
SWOT	Strength, Weakness, Opportunity, Threat
MSA	Maritime Safety Administration

CHAPTER 1

INTRODUCTION

1.1 Research background

Currently, the Yangtze River, Pearl River and other inland waters in China have become an important support for the economic development especially in central and western part of China. As the development of coastal economy has come to a relative saturation stage, the times of inland high-speed development comes, such as the “China’s Western Development”, “the Rise of Central China”, etc. There is no doubt that the inland waters have become an important channel of inland, coastal and international transport of goods.

The presence of wrecks is an important factor jeopardizing the navigation safety and environment protection, especially in inland waters. The first reason is that, subjected to the depth, radius of curvature, relatively fixed route and other restrictions, the shipping adjustable range of inland waters is small. If there is a sunken ship in the channel, it will have an adverse impact on the entire shipping of the river, or it may even generate shipping suspension crisis. It can be fatal to the inland waterway with high daily flow. For example, the downstream of the Yangtze River with daily ship flow around 2000, and the impact whether on the social or on the economy is enormous. Secondly, the prevention of water pollution has been an important

environmental issue, as the wide range oil pollution accidents happened in Dalian, the Bohai Sea and other places attracted a worldwide concern. And prevention of inland waters is more important, because it concerns the livelihood of people, especially people living along the river, and the liquidity of water makes it hard to control.

Although as early as 1957, China began to promulgate the "Procedures of the P.R.C. for the Administration of Salvaging Sunken Vessels" to manage the action of wreck salvage, and promulgated the "Regulations of the P.R.C. on Administration of Traffic Safety in Inland Waters" in 2002 to further define management function of the maritime administration, but for a long time China's competent authority has spent a lot of money on locating, marking and removing wrecks for the maintenance of public safety and shipping interests with little repaying. In addition, compared with the legal system of wrecks removal on the sea, the number of laws and regulations for inland waters is fairly small (Ge, 2013; Zhai, 2012).

On May 26, 2007, the International Maritime Organization adopted the “Nairobi International Ship Wreck Removal Convention” (hereinafter referred to as “the Convention”) at Nairobi, and the Convention came into force on April 14, 2015. The Convention establishes a series of unified rules and procedures, so as to achieve the goal that wrecks around all costal country waters can be quickly and effectively removed, and the maritime navigation safety, the ship security and the marine environment are all protected. It provides legal protection for wreck removal and removal costs, and establishes procedures to ensure the wrecks are removed timely and effectively.

Although China has got ready to access the Nairobi Convention, but it can be

forecast that it is more likely to limit in the exclusive economic zone (Zhou, 2015). Because of involving sovereignty problem, the range of application is difficult to enlarge, let alone bring the inland waters in. As the wreck removal mechanism in inland waters of China has run in to a bottleneck on account of diversity factors and constraints, the improvement of the mechanism could refer to the relevant provisions in the Convention.

1.2 The explanation of related terms

1.2.1 The Yangtze River

The Yangtze River is the longest river of China, the third longest river in the world, and the main stream flowing through seven provinces and two municipalities, where it gathers more than 41% of the total economic aggregate. The Yangtze River has the largest inland waterway transportation all over the world, and the waterway transportation represents 80% of the country's total inland waterway transportation. As the most important inland transportation waterway, the largest and busiest navigable river, the Yangtze River is the most representative inland river in China. (Changjiang MSA, 2005)

1.2.2 Wreck

The definition of the wreck is unified in the existing legal provisions. Laws and regulations of China emphasize the sinking state of the ship and the cargo is the precondition of wreck definition. The “Procedures of the P.R.C. for the Administration of Salvaging Sunken Vessels” states that “wreck” means the sunken ship with implements and cargos on it. The “Measures of the State Council for the Administration of Foreign Investors’ Participation in the Salvage of Sunken Vessels

and Objects in Coastal Waters of China" states that the wreck includes "the main body of the sunken ship" and "the implements, cargoes or other articles" (Liang, 2007). Although the concept of "sunken ship" and "sunken articles" are distinguished in some regulations, they are all included in the laws. Thus, the wreck can be defined as the sunken ship including all the articles on it, excluding the grounding ship or ship that is likely to sink but has not sunk.

1.2.3 Salvage and removal

"Salvage" means picking something from below the water to above the water. "Removal" means removing something away in the water. In current laws and regulations of China, concepts of "salvage" and "removal" are always mentioned together (Meng, 2011). In this paper, "removal" is used to represent both the meanings of "salvage" and "removal", and the "wreck removal" contains sweeping survey, detection, floatation, shifting, disassembly, removing and other related operations.

1.3 An overview of research methods

1.3.1 AHP

AHP (Analytic Hierarchy Process) is a multi-criteria decision making method, which is based on mathematics and psychology (Ishizaka &Labib, 2011). The main process of the method is decomposing the complex problems into several levels and factors, comparing the factors of each level to each other two at a time with respect to their importance, calculating the weight of each factor by establishing judgment matrix, and finally obtaining the priority of all the factors by comparing the weights aggregation. The mathematical results will help the decision maker find the one that

best suits their goal. The main steps are as follows (Saaty, 2008).

(1) Establish hierarchical model

On the basis of analyzing the problems, the various factors are decomposed into several levels from top to bottom, i.e., the goal level, the criteria level and the alternatives level (see figure 1).

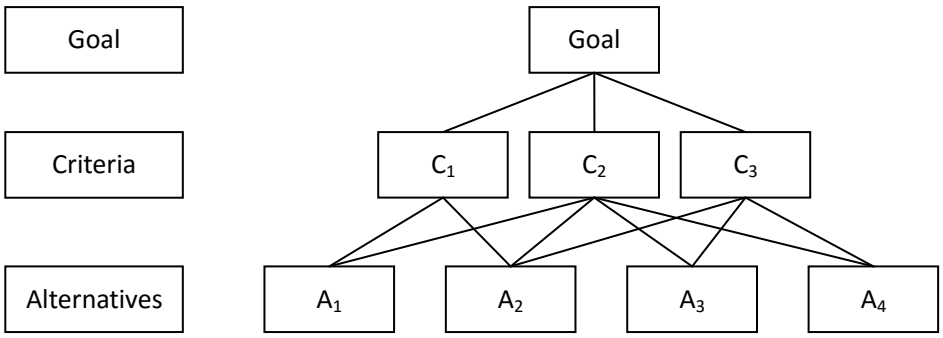


Figure - 1 AHP Hierarchy structure

(2) Construction of judgment matrix

Take one criterion at a time for analysis. The attributes contained in the next level are compared pairwise, and the comparison is given a certain value. The value scale is shown in table 1. Here $a_{ij}=1/a_{ji}$.

Table - 1 Scale of pairwise comparison

Numerical rating	Verbal definition
1	i and j are equally important

3	i is slightly more important than j
5	i is strongly more important than j
7	i is very strongly more important than j
9	i is extremely more important than j
2,4,6,8	Intermediate values

Source: Saaty (2008).

Suppose there are n attributes. After all the comparisons are finished, the pairwise comparison matrix A can be constructed as follows. In this matrix, a_{ij} is the value when comparing attribute i with attribute j.

$$A=\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}$$

(3) Calculate weight vector

The weight of each attribute can be calculated as follows.

First, calculate the geometrical mean $\overline{\omega_i}$ of each row of A

$$\overline{\omega_i} = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \ (i=1,2.....n)$$

Second, do the normalization

$$\omega_i = \frac{\overline{\omega_i}}{\sum_{j=1}^{n} \overline{\omega_j}} \ (i=1,2.....n)$$

ω_i here is value of weight.

The weight vector is

$$\omega = [\omega_1 + \omega_2 + \cdots \omega_n]^T$$

(4) Measure consistency

In AHP, the consistency of evaluation results is measured by an index CR. If CR ≤ 0.1, then the results can be accept. If CR ＞ 0.1, then the value evaluated in pairwise comparison shall be adjust. The calculation of CR is as follows (Lee & Hwang, 2010).

First, calculate the largest eigenvalue of A

$$\lambda_{max} = \sum_{i=1}^{n} \frac{(A\omega)_i}{n\omega_i}$$

Then, the consistency index (CI) is

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

The final index CR is

$$CR = \frac{CI}{RI}$$

Here RI (random index) is the mean CI value. For each size of matrix n, random matrices can be generated. The value of RI is described in table 2.

Table - 2 Random index

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

Source: Saaty (2008).

(5) Calculation of the synthesized weight

Synthesize the weights of criteria and alternatives, and the total weight list could be obtained.

1.3.2 SWOT

SWOT stands for Strength, Weakness, Opportunity and Threat. The SWOT analysis is a basic, analytical framework. On the bases of identification, the internal and external factors will be matched, and a fuller awareness of the situation will be developed. The SWOT analysis could be used to decide on the most effective direction, as well as identify the main barriers (Community Tool Box, 2016; Hu & Liu, 2009). Table 3 shows the SWOT analysis model.

Table - 3 SWOT analysis model

Internal / External	Strength	Weakness
Opportunity	SO	WO
Threat	ST	WT

From table 3 four types of the strategy can be got, namely:

(1) SO strategy. It is an ideal type of strategy that exploits the internal strengths and takes advantage of external opportunities. When organizations have the advantage of

a particular aspect, and meanwhile the external environment is favorable to give play to this advantage, this strategy is suggested to be taken.

(2) WO strategy. It is a transformational strategy that using external opportunities to make up for internal weaknesses. When external opportunity is sound but its use is obstructed by some internal weaknesses, measures changing or overcoming these weaknesses can be taken.

(3) ST strategy. It is a poly-type strategy that utilizes its own advantages to avoid the risk of the outside world. When organizations have great advantage but the external environment is poor, seeking for diversity development to mitigate external threats can be a method.

(4) WT strategy. It is a defensive strategy that reduces internal weaknesses and avoids external threats. When both the internal situation and external environment are bad, this strategy should be adopted.

CHAPTER 2

THE STATUS AND INFLUENCE OF WRECKS REMOVAL IN THE YANGTZE RIVER

2.1 Status of the wrecks

According to the statistics of Changjiang MSA (the maritime administration of Yangtze River) in March, 2016, there are totally 64 wrecks in the jurisdictions (Chongqing to Wuhu section). The wrecks are not removed mainly because of the deep water depth, rapid flow, no navigation obstruction, covered with sand for a long time and some other factors. Among the wrecks, there are six ships that are unowned ships, accounting for 9.4%. Details are as follows:

2.1.1 Distribution of region

In this paper, in order to facilitate the analysis of the wrecks' status in the Yangtze River, the jurisdictions of Changjiang MSA are divided into upstream, midstream and downstream according to the traditional habit (Changjiang Waterway Administration, 2014).

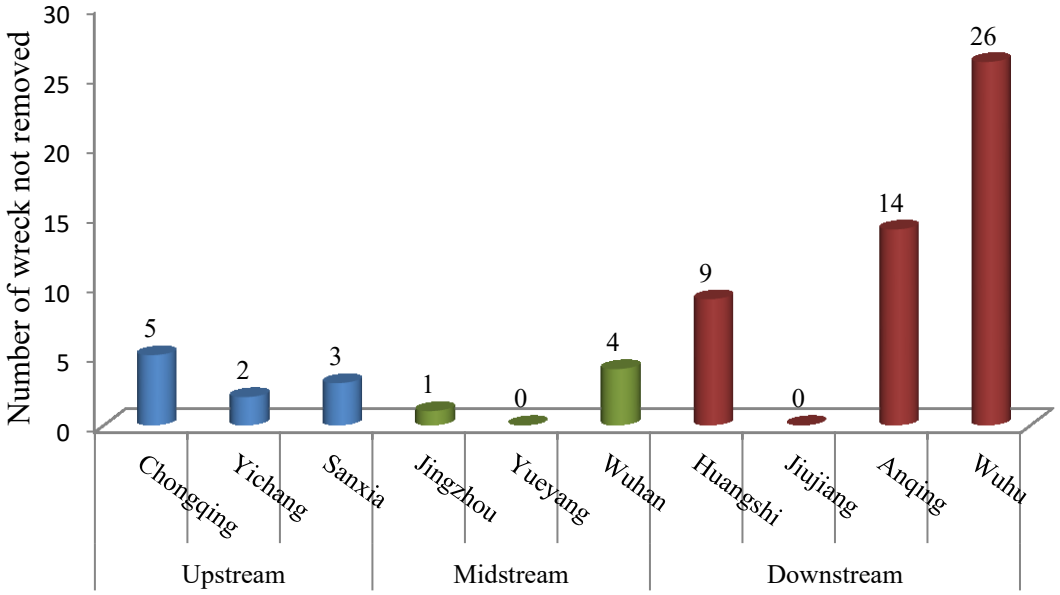


Figure - 2 Regional distribution of wrecks in Changjiang MSA jurisdictions

Source: Changjiang MSA. (2016). *Registry sheet of basic information of wrecks in Changjiang MSA jurisdictions (up to March, 2016)*.

The upstream of the Yangtze River is 1055.0KM 0kmlong from Yibin (upstream mileage 1044.0km) to Yichang (midstream mileage 615.0km), used to call Chuanjiang River, and belongs to the mountain river, which has rocky riverbed mostly, narrow bent waterway, a mess of beaches, rapid and disorder flow. There exist 10 wrecks in this region, including one hampered ship.

The midstream of the Yangtze River is 612.5km long from Yichang (midstream mileage 615.0km) to Wuhan (midstream mileage 2.5km). There are more than ten high risks and shallow waterways, such as Lujiahe, Zhijiang, Jiangkou, Taipingkou, Wuqiao, etc. This section has always been the priority among priorities of the Yangtze River waterway maintenance during dry season. At present, there is 5

wrecks including one hampered ship.

The downstream of the Yangtze River is 1020.1km long from Wuhan (midstream mileage 2.5km) to Liuhekou (downstream mileage 25.4km). This section has the largest quantity of flow, as well as the most wrecks. There exist 49 wrecks right now, including two hampered ships.

Figure 2 shows the regional distribution of wrecks in Changjiang MSA jurisdictions. Obviously, the number of wrecks is in line with the quantity of flow. In addition, the proportion of hampered ships is 6.25%, which drops dramatically comparing to that in 2006(57.6%) in inland waterway (Zhai, 2012).

2.1.2 Distribution of time

Figure 3 is the distribution of sinking time of existing wrecks in Changjiang MSA jurisdictions till March, 2016.According to the statistics, the earliest time that the existing wreck sunk was 1994. As some data are deficient, the date might be earlier.

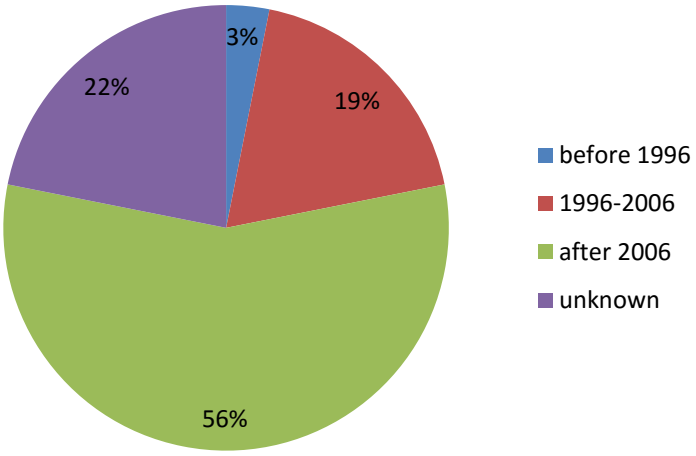
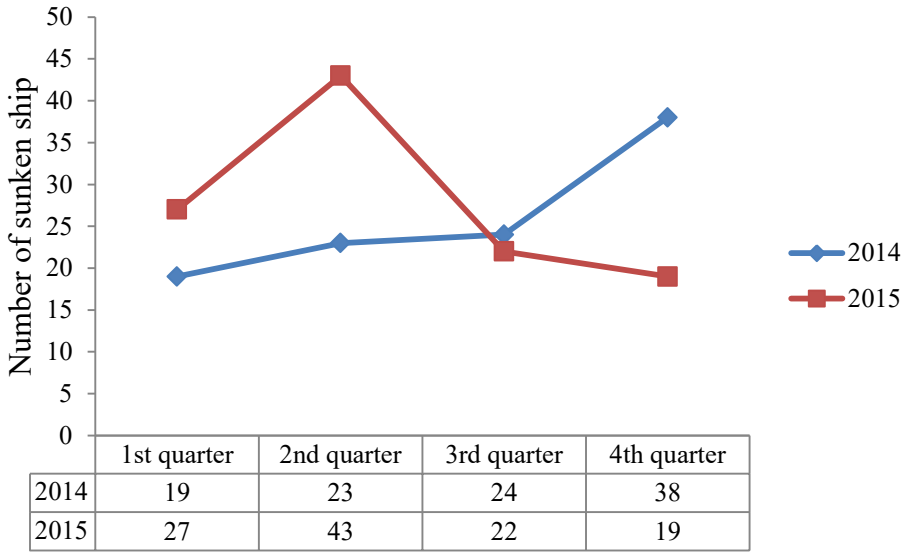


Figure - 3 Distribution of sinking time of existing wrecks in Changjiang MSA jurisdictions (up to March, 2016)

Source: Changjiang MSA. (2016). *Registry sheet of basic information of wrecks in Changjiang MSA jurisdictions (up to March, 2016)*.

According to the data of Channgjiang MSA and Jiangsu MSA (The two maritime administrations in the Yangtze River) from 2014 to 2015, there were 215 ships sinking in the Yangtze River waterway in the two years, and all of them were domestic ships. Figure 4 is the sinking time distribution of ships sinking in 2014 and 2015 in the Yangtze River. From figure 4 it can be found that the sinking time of ships have no relationship with seasons. But it should be noted that, affected by the narrow waterway in dry season or the rapid flow and high water level in flood season, the best time for wreck removal is limited. Thus the sinking time could not equate with the demand of wreck removal, and in practice, there is still a large imbalance in the wreck removal of different seasons.



	1st quarter	2nd quarter	3rd quarter	4th quarter
2014	19	23	24	38
2015	27	43	22	19

Figure - 4 Distribution of sinking time by seasons in the Yangtze River waterway (in 2014 and 2015)

Source: Changjiang MSA. *Changjiang MSA VTS reporting forms (2014, 2015)*;

Jiangsu MSA. *Rescue situation analysis reports of Jiangsu MSA maritime (2014, 2015).*

2.1.3 Removal Market

As of May, 2015, there are 29 domestic salvage institutions obtain salvage qualification in inland waters. Among them, 28 institutions have business in the Yangtze River. The distribution area of them is shown in figure 5. Affected by the open market and actual demand, most salvage institutions are located in the downstream of the Yangtze River, and that is corresponding with the distribution of sunken ships (figure 6). But the institutions are distributed sparsely above Anhui province, which is not conducive to the timely wreck removal. It is worth noting that, although the number of salvage institutions has a considerable quantity, the number of salvage institutions with high-grade qualification is limited (there are 4 institutions that have class Ⅰ qualification in inland waters, 5 have class Ⅱ qualification, and the remaining 20 institutions have only class Ⅲ and Ⅳ qualification. Furthermore,

different from the situation on the sea that the institutions with class Ⅰ qualification are all government-affiliated, there is only one government-affiliated institution in inland waters, with the addition of no charging standard exists in inland water, so the salvage market is open in inland waters and competition between institutions is little, which results in high charges.

Figure - 5 Areal distribution of salvage institutions in the Yangtze River

Source: China Diving and Salvage Contractors Association.(2015). Retrieved June 10th 2016 from the World Wide Web:

http://www.cdsca.org.cn/hyfg/dlywfg/201505/t20150522_1822320.html

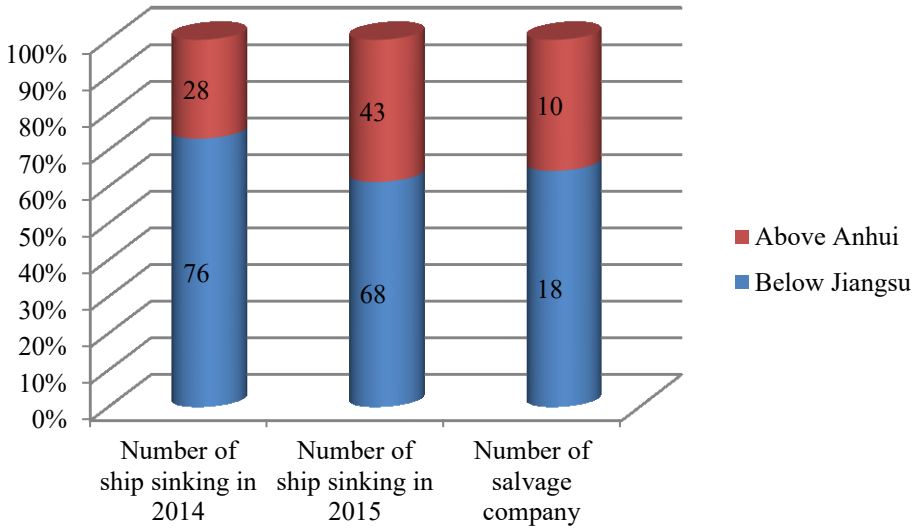


Figure - 6 Comparison of the sunken ships' number and salvage institutions' number in different regions of the Yangtze River

Source: China Diving and Salvage Contractors Association (2015). Retrieved June 10th 2016 from the World Wide Web:

http://www.cdsca.org.cn/hyfg/dlywfg/201505/t20150522_1822320.html;

Changjiang MSA. *Changjiang MSA VTS reporting forms (2014, 2015)*;

Jiangsu MSA. *Rescue situation analysis reports of Jiangsu MSA maritime (2014, 2015).*

In addition, the salvage efficiency could also be obtained from the data of the maritime administration. Taking the Changjiang MSA jurisdictions for example, there are 71 sunken ships in total, and 5 ships have not been salvage so far including 3 ships that are not salvaged because of unsuited conditions and 2 ships (one sand ship and the other fishing ship) that give up removal. Thus the salvage efficiency is rather high.

2.2 Effects of wrecks on navigation safety and environmental protection in the Yangtze River

Wrecks are important factors affecting maritime safety and environment, and they may hinder the national program of Yangtze River deep water waterway.

2.2.1 Effects of wrecks on waterway

When a wreck is located in the abyssal region of main waterway, the effect of the wreck on maritime safety is negligible. But in consideration of the long-term water erosion, the wrecks will affect the evolution of the riverbed.

If the wreck is located in the general deep region of main waterway, it may result in the water depth above the wreck becoming too shallow to navigation, which will cause serious shipping jam, and even lead to secondary accidents. There are many examples of accidents caused by the shallow water depth in the Yangtze River. For instance, on August 17, 2009, the “HX 1” and the “WSH 228” collided in Tai Ziji Waterway, and the “WSH 228” sunk immediately. Shortly after the accident, two ships ran into the “WSH 228”. As a result, one ship named “HF 199” damaged in the bottom and beached on the left shore, while the other ship soon sunk in the waterway unfortunately (Zhao, 2013).

Wrecks can also cause partial riverbed changes. After a long-term water flow, the upstream of the wreck may generate pits, and the downstream of the wreck may generate sandbags. In August, 2009, the “WSX 1668” sunk in Heinan Waterway. After 77 days, underwater survey map shows there is a 15 meters deep pit in front of

the wreck, a 230 meters long and 70 meters wide sandbag behind, and the minimum depth is only 3.4 meters (Wang, 2010). It has a great impact on the shipping, as the waterway becomes narrow and hard to maintain.

Another situation is that the wreck is located outside the main waterway, and it will have a certain impact on the small ships sailing along the coast. Especially in the dry season, when the water depth is shallow, or in heavy weather, when the ships need to anchor, accidents of collision or anchor loss may happen.

2.2.2 Effects of wrecks on environment

The water quality of the Yangtze River is related to the health and well-being of people living along the river, yet wrecks or residue of dangerous goods are seriously harmful to the water quality. On May 21, 2003, thick oil was floating under the Jianghan Bridge in Wuhan with choking smell (Zhang & Wei, 2003). Through investigation, people found it was due to a sunken oil tanker loaded with 50 tons of diesel. The leakage of diesel caused pollution of a large area on the Yangtze River.

CHAPTER 3

STATUS AND PROBLEMS OF THE WRECK REMOVAL MECHANISM IN INLAND WATERS OF CHINA

3.1 An introduction to current domestic relevant laws and regulations

At present, the legal system of wreck removal mechanism in inland waterway of China is composed of 3 special and 5 comprehensive laws or regulations. The regulations specifically for inland waterway wreck removal are the “Procedures of the P.R.C. for the Administration of Salvaging Sunken Vessels”, the “Measures of the State Council for the Administration of Foreign Investors' Participation in the Salvage of Sunken Vessels and Objects in Coastal Waters of China" and the “Regulations for the Qualification of Wreck Salvage Institution”. But they all lack integrity, systematicness and foresight. Among them, the last regulation, entered into force in April, 1999 and did not make relevant provisions about the substantive and procedural issues of wreck removal, has been abolished by Ministry of Transport in February, 2015, and now the China Diving and Salvage Contractors Association takes responsibility to approval the qualification and classification of salvage institutions.

Entering into force in October, 1957, the “Procedures of the P.R.C for the

Administration of Salvaging Sunken Vessels" is the most specific administrative regulations for wrecks removal in China. However, because it was approved in the planned economy period, the regulation is mainly based on the reuse of wrecks, and many of its provisions reflect the characteristics of the national policy in the planned economy period. With the progress of the society and the development of shipping industry, people pay more attention to the shipping safety and environmental protection in inland waters, the reuse of wrecks has become less important, and therefore the procedure cannot meet the need for the development of shipping industry.

Entering into force in July, 1992, and revised in 2011, the "Measures of the State Council for the Administration of Foreign Investors' Participation in the Salvage of Sunken Vessels and Objects in Coastal Waters of China" mainly focuses on the participation of foreign investors, and states merely on specific aspects such as the application, rights and obligations, disposal the wrecks, etc.

Other laws, regulations and judicial interpretations have only a few dispersive provisions related to inland river wreck removal.

The "Regulations of the P.R.C on Administration of Traffic Safety in Inland Waters" entered into force in June, 2006, and has stipulated clearly and definitely that the maritime administration is the competent authority in dealing with wrecks removal and other measures.

The “Waterway Law of the P.R.C” entered into force on March 1st, 2015. It is a national law to standardize and strengthen programming, construction, maintenance, protection of waterway.

The “Detailed Rules for the Implementation of the Water Pollution Prevention and Control Law of the P.R.C.” entered into force on March 20th, 2000, and the “Provisions on the Prevention and Control of Vessel Pollution of the Inland Water Environment of the P.R.C.” is revised on May 1st, 2016. Both focused on avoiding environment pollution caused by wrecks to inland water.

The “Administrative Compulsory Law of the P.R.C.” entered into force on January 1st, 2012. The part that involves wrecks removal is guiding the maritime administration to conduct compulsory removal measures. It states the procedures of substituted fulfillment in case that the hazard cannot be removal by the responsible subject in time.

3.2 Responsibilities of relevant subjects in wrecks removal in the Yangtze River

3.2.1 Changjiang MSA and Changjiang waterway administration

The Changjiang MSA and Changjiang waterway administration are responsible for the management of wrecks removal in the Yangtze River. In June, 2016, the maritime management system of the Yangtze River has reformed. After the reform, the Changjiang MSA takes responsibility on detail work of wreck removal and the relevant supervision management, and Changjiang waterway administration takes responsibility on buoy setting. The new pattern is as follows.

The rules for comprehensive law enforcement on the Yangtze River states that the maritime administration conduct inspection work by moving around, and the inspection includes whether the wrecks impede navigation. If there existing hampered wrecks, the maritime administration shall order the ship owner or operator to set dedicated buoy. If the ship owner or operator does not fulfill their obligations or the wreck may result in secondary accident, then the maritime administration shall replace the fulfillment and set dedicated buoy. The specific job can be entrusted to the waterway administration. After wrecks removal, the maritime administration shall inform the waterway administration to dismantle dedicated buoy.

3.2.2 Ship owner and operator

A ship owner is the owner of the ship according to the manner and the logical structure of the general property owner, namely the person who has the ownership of the ship. A ship operator means the legal person according to the contract agreement, and represents the ship owner to exercise of the operating right. A ship operator can only be a legal person, i.e., a natural person cannot be a ship operator (Shan, 2007). This point is quite important for the ships in the inland waters. Most ship owners in the Yangtze River are self-employed, and generally they are low literacy and low quality, with the whole family working for the sole ship. Because of the relevant provisions on the ship operator, the ship has to be subordinate to an operating company rather than operated by the ship owner itself. This combination brings great challenges to wreck removal, which will be discussed later in this paper.

As a whole, the responsibilities of the ship owner and ship operator referring to wreck removal are mainly as follows:

(1) Report immediately to the local or the nearest maritime administration after the wreck accident, and take necessary measures to prevent further loss and damage actively;

(2) Remove wreck to fulfill obligations within the time limited by the maritime Administration; and

(3) Bear the costs of the compulsory removal.

3.2.3 Salvage institution

Salvage institution mainly engages in commercial activities according to their qualifications and abilities. Their work is carrying out underwater wreck removal and signing the commercial contract with the responsible subject.

In addition, the salvage institution shall accept the relevant management:

(1) Accept the supervision and management of the national maritime administration when engaging in wreck removal job;

(2) Accept qualification management of Diving and Salvage Contractors Association of China; and

(3) Accept the delegation from the maritime administration to carry out compulsory wreck removal.

3.2.4 Insurer

At present, the wreck removal liability insurance in the Yangtze River is mainly carried out by the China Ship owners Mutual Assurance Association (P&I Club of China) and major commercial insurance companies (China Ship owners Mutual

Assurance Association, 2015).

In addition, the “Regulations on Administration of Traffic Safety in Inland Waters” states that to vessels that shall obtain the insurance documents or the certificates of financial security for pollution damage liabilities and for wrecks removal liabilities in accordance with the provisions of the State, and their owners or operators shall obtain such insurance documents or certificates of financial security and provide a copy onboard. Applicable objects of wreck removal liability insurance are mainly the ships engaged in commercial and production activities. In order to disperse the liability risk, ship owners should purchase the wreck removal liability insurance from the insurance company. The insurance company should accept the wreck removal liability insurance application, or reinsurance in accordance with administrative regulations.

However, the provision in the Regulations is not so clear that the insurance is not adopted in inland waters. In fact, because of the poor ship conditions and company management and for the sake of saving costs, there are a large quantity of ships, especially small and medium sized ships and old ships, have not joined the Association or buy the Protection and Indemnity Cover (P&I Cover) in the Yangtze River.

3.3 Classification of wreck removal

According to the difference on the purpose of wreck removal, the initiative of liability subject, the implementation subject and the obligations of relevant parties, the wreck removal in inland waters could be divided into three categories (Luo, 2004;

Wu, 2012).

The first category is that the wreck has no danger. In this case, the subject responsible for wreck removal obligor may sign a removal contract on the basis of consensus with the salvage institution for acquiring the wreck's commercial value. The removal will be implemented by the salvage institution, and the expenses of removal will be paid to the salvage institution by the subject responsible in accordance with contract. This category of removal is purely commercial in nature, belongs to the realm of civil relationship law.

The second category is that when the wreck is dangerous, the maritime administration will inform the subject responsible to salvage the wreck in stated time, and finally the subject responsible fulfills its obligations. In this category, the maritime authorities will be involved in the removal because of that the wreck should be salvaged in time or else it may affect the navigation safety or pollute the environment. After the accident, the maritime administration shall do as follows: determine the nature and extent of severity by investigation, mark the wreck, announce Navigational Warnings & Notices to mariners, and take other security or risk prevention measures. After the extent of severity has been determined, the subject responsible will be noticed to fulfill the obligations, and sometimes may be enforced to carry out the removal in stated time. At this stage, if the responsible subject signs a removal contract with the salvage institution and finishes the removal, then the wreck removal obligation will be fulfilled. Under this circumstance, the rights and obligations of the subject responsible are the same as those in the first category, as the removal contract is signed based on consensus and by equal civil

subjects. Thus the contact belongs to the realm of civil law, and the process of signing the contract also includes certain autonomy. But there is one difference with the first category that maritime administration plays a role in the establishment of contract. Given this, the nature of this category can be classified as quasi-commerce, and it concludes administrative factor, notwithstanding it belongs to the realm of civil relationship law.

The third category is that the wreck is dangerous, and the maritime administration informs the subject responsible to salvage the wreck in stated time, but finally the subject responsible doesn't fulfill its obligations, or that the circumstance of wreck is too urgent to inform the subject responsible and the maritime administration carry out the removal immediately. In this category, the subject responsible fails to fulfill its obligation of wreck removal because of various reasons, and the maritime administration carry out the removal forcibly of their own accord for safety or environmental protection. After the wreck is cleared, the administration will ask the subject responsible for removal expenses. In such progress, the relationship between the subject responsible and the administration is "administrative subject" and "administrative counterpart". Obviously the legal statuses of both parties are unequal, that is, the subject responsible is entirely restrained by administrative compulsion, and there is no civil contract between them. This kind of removal is called compulsory removal. This category belongs to the realm of administrative compulsory.

These three categories of wreck removal are similar in some respects, for instance, the party implementing the removal is the salvage institution. But they are different

in several aspects.

(1) Difference in terms of the organizers of removal activities. Purely commercial and quasi-commercial removal are organized by the ships' owners or operators, but it is the maritime administration, such as the Changjiang MSA in the Yangtze River, that organizes the compulsory removal, which is the important feature of compulsory removal.

(2) Difference in terms of the dangerousness of subject matter. Subject matter in purely commercial removal is not hazardous as it is generally, sunken in deep waters, will not cause obstruction of traffic and has no cargos which may cause environmental pollution such as crude oil, chemicals or radioactive materials. Quasi-commercial removal and compulsory removal of wreck has a certain risk because that the subject matter is generally sunk in the waterways, berths, shallow water areas, etc., endangering the safe navigation of other vessels, or cargos on sunken ships may leak out crude oil, toxic chemicals or radioactive substances, which will seriously pollute the water environment.

(3) Difference in terms of the nature of behavior. As mentioned above, purely commercial removal is a civil act. Quasi-commercial removal is a behavior involves administrative factor but still belongs to civil act. Compulsory removal, implementing in accordance with administrative regulations, is an administrative action.

(4) Difference in terms of the initiative. In purely commercial removal, due to the low risk and high value of sunken ships or cargos, it is entirely the liability subject's own initiative action. In the quasi-commercial removal, the subject responsible is usually not so eager to carry out the removal. But the subject responsible will carry out the removal after being informed for fear of that the expenses charged by the maritime administrations after compulsory removal may be higher than the costs incurred if they do by themselves, or because they estimate the wreck value and the cost is flat. In compulsory removal, the liability subjects are usually entirely negative and want to avoid responsibility. When a situation occurs that the wreck has little value, much less than the costs, and the ship owner is a single-ship company, shell company or foreign company. They generally decide to escape, declare bankruptcy or put aside after measuring the interests.

(5) Difference in terms of mandatory. As analyzed above, purely commercial removal is a totally voluntary behavior, the quasi-commercial removal is a semi-voluntary behavior under supervise and urge of the maritime administration, and compulsory removal has full mandatory.

(6) Difference in terms of restriction region. Purely commercial removal has no restrictions from the region. The subject responsible can carry out removals on the high seas, territorial waters, inland sea and all other navigable waters. While quasi-commercial removal and compulsory removal are related to the notice and prevention measures of the administration, so they must be carried out in waters of their respective jurisdiction, including the country's harbors, inland waters, seas, territorial waters, continental shelf, exclusive economic zone, the contiguous zone

and other jurisdictions.

3.4 Relationships among legal subjects

The actions of wreck removal involve both administrative and civil relationship. No matter what forms the action is, the involved subjects are mainly the maritime administration, the subject responsible and the salvage institution.

3.4.1 The relationship between the maritime administration and the responsible subject

The relationship is mainly reflected in the quasi-commercial and compulsory removal. The maritime administration represents the nation to exercise the administrative power, and issue notices of wreck removal or carry out wreck removal in case of emergency. The legal status of the maritime administration is the administrative body of a specific administrative act, and the relationship with the responsible subject is administrative (Zhang, 2008). After the compulsory removal, the maritime administration shall be entitled to claim compensation for its expenses from the responsible subject.

In practice, the compensation claims vary in different places. Generally the maritime administration will use the administrative compulsion, and use the residual value of wreck as collateral. For whose removal costs exceed the residual value of wreck, the maritime administration in the Yangtze River generally apply the national treasury to provide support, as the wreck removal in the Yangtze River is relatively low-expense and easy-work. In the inland water of Shenzhen, a fund will be raised from benefited party by Shenzhen maritime administration to ensure the continuity of removal work.

In Dalian, the maritime administration will force the responsible subject to provide security or guarantees before starting the work (Gao, 2007).

3.4.2 The relationship between the maritime administration and the salvage institution

In the case of quasi-commercial removal, if the responsible subject has concluded a contract with the salvage institution and has finished the removal, then the maritime administration authorities and the salvage institution have no relationship.

In the case of compulsory removal, the maritime administration authorities and the salvage institution are of commission contractual relationship. The former is entrusting party and the latter is commissioned party. It is civil legal relation between two equality subjects. There is exception in coastal waters when the removal is taken by the Rescue and Salvage of Ministry of Transport of the P.R.C., then the relationship between the two subjects is administrative entrustment. In inland waters, most of the salvage institutions are private enterprises, so it is mainly civil legal relationship.

Some scholars hold other views on this. According to Zhang Yi's study (2008), being a state agency, the maritime administration cannot be a contractual subject. Thus in case of disputes, the salvage institution cannot claim compensation of expenses from the maritime administration. Therefore in practice, the salvage institution will not accept an agreement signed with maritime administration easily.

3.4.3 The relationship between the responsible subject and the salvage institution

In the non-compulsory removal, if the subject responsible authorizes the salvage institution to carry out the removal, then they have a relation of civil contract. Moreover, in this case, if the responsible subject claims compensation from the third party, then the two subjects have civil legal relationship, and the salvage institution has no relationship with the third party.

In compulsory removal, the salvage institution takes part in the removal in an authority agent capacity. So the responsible subject and the salvage institution have no relationship.

3.5 Problems of current mechanism

3.5.1 The subject responsible in various laws is not uniform

There are several laws and regulations that involve wreck removal of inland waters, and there are conflicts of provisions on subject responsible for wreck removal (Zhao, 2007). The subject responsible in various laws is not uniform now and been a very important legal issue that inland maritime administrations faces, especially at the time of compulsory removal.

The article 5(2) of the “Procedures for the Administration of Salvaging Sunken Vessels” states that the sunken vessel’s owner must submit an application and salvage within the prescribed time limit; otherwise, the relevant maritime competent

administrations can carry out the salvage or disintegration removal. Article 8 states that the sunken vessel's owner can apply for reimbursement of the original or the proceeds obtained from processing the original within a year, if not its ownership will be lost. Sunken ship's owner shall repay the cost of salvage, storage and processing when taking back the original or the proceeds.

Article 42 of the "Regulations on Administration of Traffic Safety in Inland Waters" states that the owner and operator of sunken, drifting or stranded objects shall set up signs in accordance with the relevant provisions, report to the maritime administration, and carry out the removal in time limited by the maritime administration; objects with no owners or operators available, in order to guarantee navigation safety, shall be removed or be taken other appropriate measures by the maritime administration.

Article 21(2) of "Waterway Law" states that the owner or operator of vessels, facilities or other objects sunken in navigation water, which affects the navigability or navigation safety of the waterway, shall immediately report to the waterway administration and maritime administration, and set up signs independently or authorize the waterway management administration and maritime administration to set one. The salvage and removal shall be carried out in time limited by the maritime administration.

Article 30 of the "Detailed Rules for the Implementation of the Water Pollution Prevention and Control Law" states that to accident vessels, which cause or are likely to cause pollution, the maritime administration shall organize compulsory removal or

tugging, and all expenses shall be paid by the ship responsible for the accident.

Article 36 of the “Provisions on the Prevention and Control of Vessel Pollution of the Inland Water Environment” states that to accident vessels, which causes or is likely to cause pollution to inland water, the owner or operator shall eliminate the pollution effect. The effect cannot be eliminated in time, the maritime administration can take necessary measures such as removal, salvage, towage, pilot, lighterage, and the cost shall be paid by the subject responsible. Vessels and its owner or operator, which should bear the cost, shall pay off the charge or provide appropriate financial guarantee before sailing.

Table 4 shows comparison of subject responsible for wreck removal in different laws or regulations. It could be concluded from the table that there are three different stipulations. This kind of legal system increases the difficulty of determining the main responsible subject which is prone to bringing legal disputes. For example, if a ship sinks in collision, the authority could only ask the ship owner for wreck removal in accordance with the “Procedures on Administration of Salvaging Sunken Vessels”, or could ask the ship owner or operator to fulfill the obligations according to “Regulations on Administration of Traffic Safety in Inland Waters” and others. If the collision cause inland water pollution, then the liability ship of the accident should also be responsible for the wreck removal according to “Detailed Rules for the Implementation of the Water Pollution Prevention and Control Law”.

Table - 4 Domestic laws and regulations on the subject responsible for wreck removal

Laws and regulations	Publishing Agency	Liability subject
Regulations on Administration of Traffic Safety in Inland Waters	The State Council	Ship owner or operator
Procedures on Administration of Salvaging Sunken Vessels	Ministry of Transport	Ship owner
Waterway Law	National People's Congress	Ship owner or operator
Detailed Rules for the Implementation of the Water Pollution Prevention and Control Law	The State Council	Ship responsible for accident
Provisions on the Prevention and Control of Vessel Pollution of the Inland Water Environment	Ministry of Transport	Ship owner or operator

3.5.2 Wreck removal costs cannot be guaranteed

In the compulsory removal, the problem of costs cannot be guaranteed has been the prime obstacle. The reasons of this problem are mainly as follows.

(1) Deficiency of special fund

Nowadays, solving the problems that the owner or operator is not able to pay for the wreck removal costs and that sunken “unowned ship” removal has no fund has been the main work of the maritime administration in wreck removal management, resulting from the deficiency of special fund (Xu, 2010).

In practice, once there is an accident needing wreck removal, then the ship owner or operator will face financial pressure from the sinking accident as well as the wreck removal. For those low obligation ability companies such as a single-ship company, bad management operator and “agent-but-no-management” operator, which existing widely in inland waters, the high cost-income ratio will impel them to ignore the compulsory removal notice under the pretence of bankruptcy or even escape. In this case, if the maritime administration does not organize the removal, then they will face administrative omission liability. While if the maritime administration takes displacement of fulfillment, and authorizes the salvage institution to finish the removal, then they will face risk of cannot recover the expenses. Because the maritime administration has the obligation to pay the salvage institution for the removal, and the action is public as it has no special administrative expenditure for the removal or corresponding legal regulation to protect the fund achievement, so if the compensation from the responsible subject is inadequate, then the authority will be in a dilemma.

In addition, the Article 42 of “Regulations on Administration of Traffic Safety in Inland Waters” states explicitly that the maritime administration has the obligation of salvage “unowned ship”. In such an area where numerous “three no’es” (no vessel

name, no registry port, no certificate) haunting frequently and hard to clamp down, the burden on the maritime administration in the Yangtze River increases once again.

(2) Related Insurance has disadvantages

"Advance payment principle" is generally accepted by many P&I Clubs (Han, 2007). In China, P&I Club states the principle in its regulation: “Unless the board of directors specify, before member obtain the compensation from the Association for relevant liability and cost, it must fulfill those liabilities and pay off the cost in advance.” and “The prerequisite of a member obtain the compensation for any loss, damage, liability, costs and expenses is the member or assignee or other person on behalf of the member has paid off all dues or other accounts payable.” That is, the ship owner will not obtain the compensation from the insurer if it has no ability to pay off the expense.

However, suppose that if the owner of wreck has sufficient capacity to pay for the removal in advance, then it will probably not generate the action of compulsory removal, afterwards the compulsory removal cost will not be an issue. Moreover, the current legislation in China has not adopted “direct action” in the pay-off of wreck removal, i.e. the maritime administration cannot claim compensation for compulsory removal directly from the ship insurer. This is because that the Association does not belong to the commercial insurance companies that Insurance law of China has defined, thus the insurance contract between the member and the Association does not belong to commercial insurance, and it applies the regulations of “Contract law” rather ran ”insurance law”. Hence if compulsory wreck removal occurs, the maritime

administration cannot claim insurance compensation for insurer as it is not the contract party.

Since the Association faces its members directly, and there is no “Direct action” in the voluntary insurance, therefore the competent authority, which has paid for the compulsory removal in advance, is impossible to cross the “Advanced payment principle” and obtain the compensation directly from the Association. Thus it can be seen that under the existing vessel liability insurance system, due to the “Advanced payment principle”, even if the wreck owner has insured liability insurance in advance, it can rarely obtain a timely and effective compensation from liability insurer.

3.5.3 The salvage market encounters difficulties

One difficulty is that the operating cost is increasingly higher. Due to the improvement of safety management in inland water, with addition of the continued depression of shipping market, the need of salvage and removal gradually decreases, and the average distance is elongated. What’s more, the steel price plummeted, so the measure mentioned above, that using the residual value as guarantee to restore the loss of the salvage institution, is losing its effect. In practice, the professional salvage institution in inland waters has expanded other business, such as on/under water engineering, besides ship salvage and wreck removal.

Besides, the salvage power needs upgrade because of the trend of large-sized of inland ships. The traditional pontoon salvage form cannot meet the need of current salvage any more, which requires that the salvage institution should build floating

crane with larger size. Although the shoreline inland is already rather long for the small scale of salvage companies, they should possess a larger floating crane to seek for wider radiant waters, so as to participate in more salvage projects and meanwhile reduce the maintenance cost by reducing the number of equipment. But unfortunately, the development of large size floating crane in the Yangtze River is limited by the clearance height restrictions of Nanjing Yangtze River Bridge and Wuhan Yangtze River Bridge, which results in the nonparticipation of large-sized floating crane below Nanjing or Wuhan into the emergency response and salvage of upstream or midstream. The resource sharing cooperation among the salvage companies is also blocked. For instance, in the accident in 2015 that "Oriental Star" sunk in the midstream of the Yangtze River, the large-sized floating crane with advanced equipment at the downstream were unable to participate in the salvage work.

Another difficulty is that although salvage institutions of China accepts the qualification management and assessment of China Diving and Salvage Contractors Association at present, there is no charging standard for inland salvage. As most salvage institutions are private enterprises, the cost they offer is often too expensive to be accepted, which impedes the salvage progress.

3.5.4 Other issues in inland water

It is mentioned above that many ship owners and operators are separated in inland waters. However, the majority laws and regulations of China state that the wreck “owner or operator” is the responsible subject. This is likely to generate phenomenon of mutual buck-passing, especially for inland unique "sand-boat". The owner of “sand-boat” is usually personage, and the operator is company with weak strength. The safety performance is generally poor, and in most cases the operator is so called

“agent-but-no-management” company. As can be predicted, illegal activities, e.g. overloading and inadequate manning, often happen on this kind of boat. As the earnings from illegal sand mining is so high that they are normally “three no’es” boat and appear on the sneak. The illegal activities are continued despite repeated prohibitions, let alone once accident happens. Thus the mutual buck-passing between ship owner and operator has brought threats to management of the maritime administration.

Furthermore, there is a big gap in the quantity of professional public salvage team and salvage equipment in port, which gives rise to weak emergency salvage capacity. And there are little regulations involving the local government. As a matter of fact, the support from the government is slight because that in China the maritime administrations are directly under the ministry of transport and there is no leader-member relation between the two agencies.

In addition, the existing inland wreck removal mechanism focuses more on the effect on navigation safety, but ignores the effects on ecological environment protection, which also needs to improve.

CHAPRTER 4

IMPACTS OF THE INTERNATIONAL CONVENTIONS ON DOMESTIC LEGISLATION

4.1 The Nairobi Convention

Although China did not join the "Nairobi Convention", the provisions in the Convention have positive inspiration on the inland wreck removal domestic legislation.

4.1.1 Legislative Purpose

There is only one regulation in China that is established particularly for the wreck removal. The purpose of "Procedures on Administration of Salvaging Sunken Vessels", issued in 1957, was just guaranteeing the recycling of the wreck, rather than taking environmental protection or navigation safety into account. Since the environmental protection or navigation safety have drawn attention of the public, especially the people living along the riverbank, the two points should be brought into the legal system of wreck removal, just like that in the "Nairobi Convention". In addition, the definition of "hazard" of wreck is expanded in the Convention, which means any condition or threat that:

(a) poses a danger of impediment to navigation, or

(b) may reasonably be expected to result in major harmful consequences to the marine environment, or damage to the coastline or related interests of one or more States.

These factors also need to be taken into account within the new legislative purpose.

4.1.2 Reporting and Locating

Current laws and regulations of China require ships in the event of an accident to report timely to the maritime administration. But since the report format is non-uniform, some reports in practice lack a lot of valid contents, resulting in difficulty in judging the situations by the maritime administration (Yao, 2016). There, the reporting regulations in the Convention could be the reference. In inland water, the report shall be reported by the master without delay, and the report shall provide the name, the registered port, the type and size of wreck, the damage, the nature and quantity of cargo and bunker oil, and the precise location. As regards the wreck locating, there is no specific regulation in existing laws and regulations of China. In practice, it is the maritime administration that established the location of wreck, which is in keeping with the Convention. Thus in the next step, the obligation of the State can be defined in the new laws.

4.1.3 Compulsory insurance and direct action

As mentioned above, the owner of “single-ship” company in inland water often refuses to fulfill obligation to salvage. And even the wreck has insured liability insurance, but because of the presence of the “Advanced payment”, fearing to be unable to get compensation afterwards, the ship owner would rather decide to get bankrupt than pay for the removal expenses in advance (Bi, 2007). In addition, the maritime administration, which represents the public interest, could not obtain the

compensation because of the deficiency of direct action. Thus the regulations on compulsory insurance and direct action in the Convention could be referred to the content of the new laws.

4.1.4 Definition of the responsible subject

For the problem of stipulations on the responsible subject differ in laws and regulations of China, the provision in the Convention fits the status of inland rive r quite well. In the Convention, the "registered owner" of the ship is the sole responsible subject to remove the wreck. Then in the new legal system of inland waters, it can be defined that the ship owner shall remove the wreck determined to constitute a hazard, whether the hazard is caused by the ship or the cargo, and regardless of the ship is operated by the ship owner itself or rented out by someone else, as long as it is the ship registered owner, then it should bear the responsibility to wreck removal. And provision shall states that the ship owner has the right of claim after wreck removal.

4.2 The CLC Convention and Fund Convention

The development of marine oil pollution damage compensation system in China can provide some references for inland wreck removal mechanism.

The big risk on vessel-induced oil pollution damage resulted in the increase of demand on construction of compensation system, and so China accepted the International Convention on Civil Liability for Oil Pollution Damage (the CLC Convention). However, China does not accept any Fund Convention (International Convention on the Establishment of an International Fund for Compensation for Oil

Pollution Damage) because that China will contribute a huge amount to the fund organization if join the Fund Convention. To make up the gap of the domestic marine oil pollution damage compensation mechanism, On May 11, 2012, the "Administrative Measures for the Collection and Use of Compensation Funds for Vessel-Induced Oil Pollution Damage" was promulgated jointly by the Ministry of Transport and the Ministry of Finance of the P.R.C., and established the oil pollution compensation system with double layers. Comparing with previous regulations, the Measures makes many breakthroughs in the collection standards, the limits of liability, the timelines of claims, and the right of subrogation of Management Committee. According to the Measures, the nature of the compensation fund for oil pollution damage is characterized as government funds, which not only has rights of collection, remitting and management, but also assumes the compensation liability for specific pollution damage. Although the Measures have drawbacks on collection range and use sequence (Jiang, 2016), but it can also use for reference to the construction of inland wreck removal mechanism without any fund system, especially for the compulsory removal.

CHAPTER 5

SWOT ANALYSIS FOR THE IMPROVEMENT STRATEFY OF WRECK REMOVAL MECHANISM IN INLAND WATERS OF CHINA

Based on the above analysis, the SWOT model of the wreck removal mechanisms in inland waters of China is built as table 5.

Table - 5 SWOT model of wreck removal mechanisms in inland waters of China

	Opportunities	Threats
External	1. Comprehensive law enforcement system is developed 2. The coming into force of the Nairobi Convention provides reference 3. Improvement of the oil compensation mechanism provides reference	1. The ship owners or operators have poor ability to fulfill obligations 2. Trend of large-scale ship demands higher navigation condition and salvage power 3. The operating cost is high for salvage institution

	Strengths	Weaknesses
Internal	1. Comprehensive law enforcement system is built and fairway safety can guarantee 2. Salvage companies distribute rational in relatively open market 3. Operation cost is low for ship owners/operators without compulsory removal insurance	1. Liability subject is different and blurry in diverse regulations 2. Legislative purposes doesn't focus on environment protection 3. Cost compensation of removal can't guarantee 4. Local government has low degree of participation

According to the domestic situation and experience, the judgment matrixes are established as follows (Table 6(a) to Table 6(e)), and the comprehensive weight vector is shown in figure 7. In the matrix A, the strength, weakness, opportunity and threat are the four criteria of AHP, and in the matrix S, W, O, and T, the sequence of attribute is respectively one to one corresponding with the factor in table 5.

Table - 6(a) Judgment Matrix A

A	Strength	Weakness	Opportunity	Threat	Weight vector
Strength	1	1/5	1/3	1/2	0.0851

Weakness	5	1	3	3	0.5159
Opportunity	3	1/3	1	3	0.2622
Threat	2	1/3	1/3	1	0.1368

λ_{max}=4.1308 CI=0.0436 CR=0.0484

Table - 6(b) Judgment Matrix S

	S_1	S_2	S_3	Weight vector
S_1	1	5	3	0.6370
S_2	1/5	1	1/3	0.1047
S_3	1/3	3	1	0.2583

λ_{max}=3.0385 CI=0.0193 CR=0.0332

Table - 6(c) Judgment Matrix W

	W_1	W_2	W_3	W_4	Weight vector
W_1	1	5	1/3	3	0.2648
W_2	1/5	1	1/7	1/2	0.0612

W_3	3	7	1	5	0.5669
W_4	1/3	2	1/5	1	0.1070

λ_{max}=4.0684 CI=0.0228 CR=0.0253

Table - 6(d) Judgment Matrix O

	O_1	O_2	O_3	Weight vector
O_1	1	5	2	0.5695
O_2	1/5	1	1/4	0.0974
O_3	1/2	4	1	0.3331

λ_{max}=3.0246 CI=0.0123 CR=0.0212

Table - 6(e) Judgment Matrix T

	T_1	T_2	T_3	Weight vector
T_1	1	5	2	0.5816
T_2	1/5	1	1/3	0.1095
T_3	1/2	3	1	0.3090

λ_{max}=3.0037 CI=0.0018 CR=0.0032

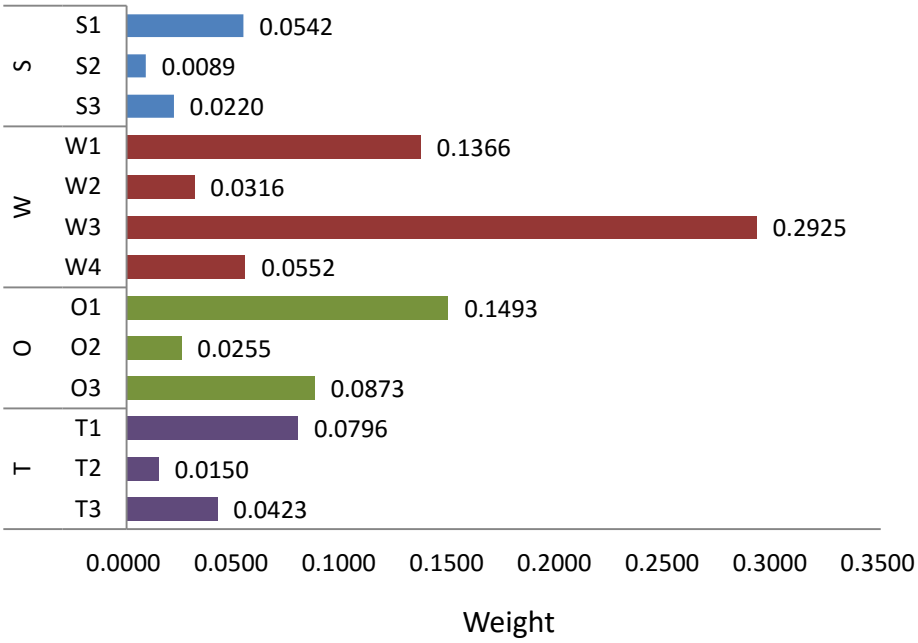


Figure - 7 Comprehensive weights of all the criteria

Then select the maximum weight value of each criterion in SWOT analysis, and get the best development strategy by the quadrilateral analysis (Wang et al., 2011). Based on the data in figure 7, the selections are S1 = 0.0542, W3 = 0.2925, O1 = 0.1493, T1 = 0.0796. Figure 8 is drawn using these values. Next, calculate the areas of the four triangles, and get the rank of areas: ΔWAO> ΔWAT> ΔSAO> ΔSAT. Therefore, the development strategy of wreck removal mechanisms in inland waters of China is suggested to select the WO strategy, which means that measures should be taken to overcome the weaknesses and take advantage of external opportunities.

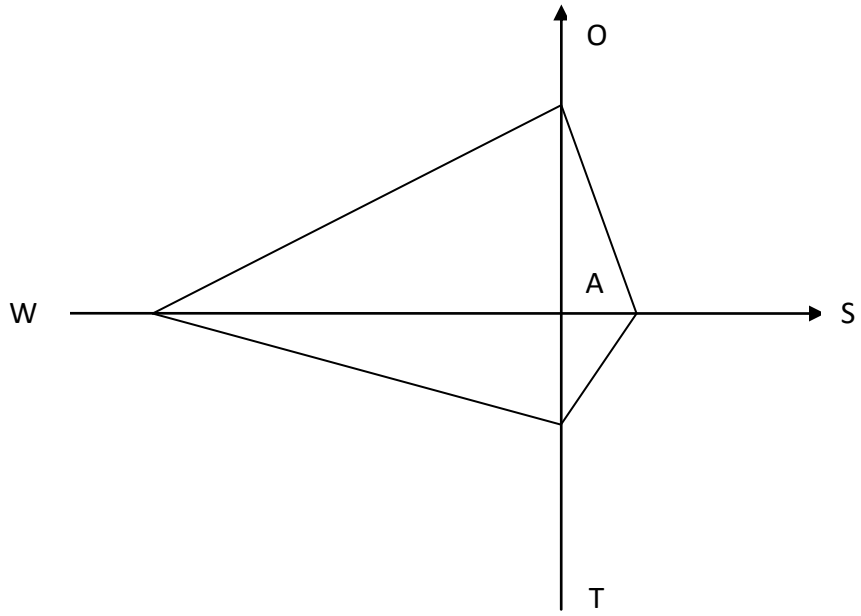


Figure - 8 Quadrilateral analysis for development strategy selection

CHAPTER 6

IMPROVEMENT SUGGESTIONS ON WRECKS REMOVAL MECHANISM IN INLAND WATERS OF CHINA

According to the analysis above, the wreck removal mechanism in inland waters of China could be improved in the following aspects.

(1) Revise the “Procedures for the Administration of Salvaging Sunken Vessels” and state that wreck removal responsibility shall be borne by the ship owner, and the ship operator, the charterer or the manager shall share the responsibility in accordance with the contract signed with the ship owner. If the revision of national legislation cannot be achieved, then the laws for inland waters shall be established first.

(2) Implement compulsory insurance and direct action gradually in inland shipping. The implementation of insurance should be hierarchical according to the ages and tonnages of vessels. With a number of old ships being denied to insure, it does more good than harm to the shipping market regulation and maintain from the perspective of the public interest.

(3) Establish wreck removal fund for compulsory removal. Following the general

principle of "the beneficiaries shall endure corresponding responsibilities", the fund shall include government funds in majority and fees charging from the ship owner and the cargo owner in minority. The funds shall be used for “unowned ships” in first priority.

(4) In the compulsory removal, the ship owners and operators shall be allowed to participate, and the local government has the ability of providing salvage facilities. The government in the port of registry shall assist the maritime administration in the investigation on ship owners and operators in compulsory removal.

(5) The local government should publish the charging standard for salvage and removal within its administration region.

The suggestion on the regulation establishment is shown in figure 9.

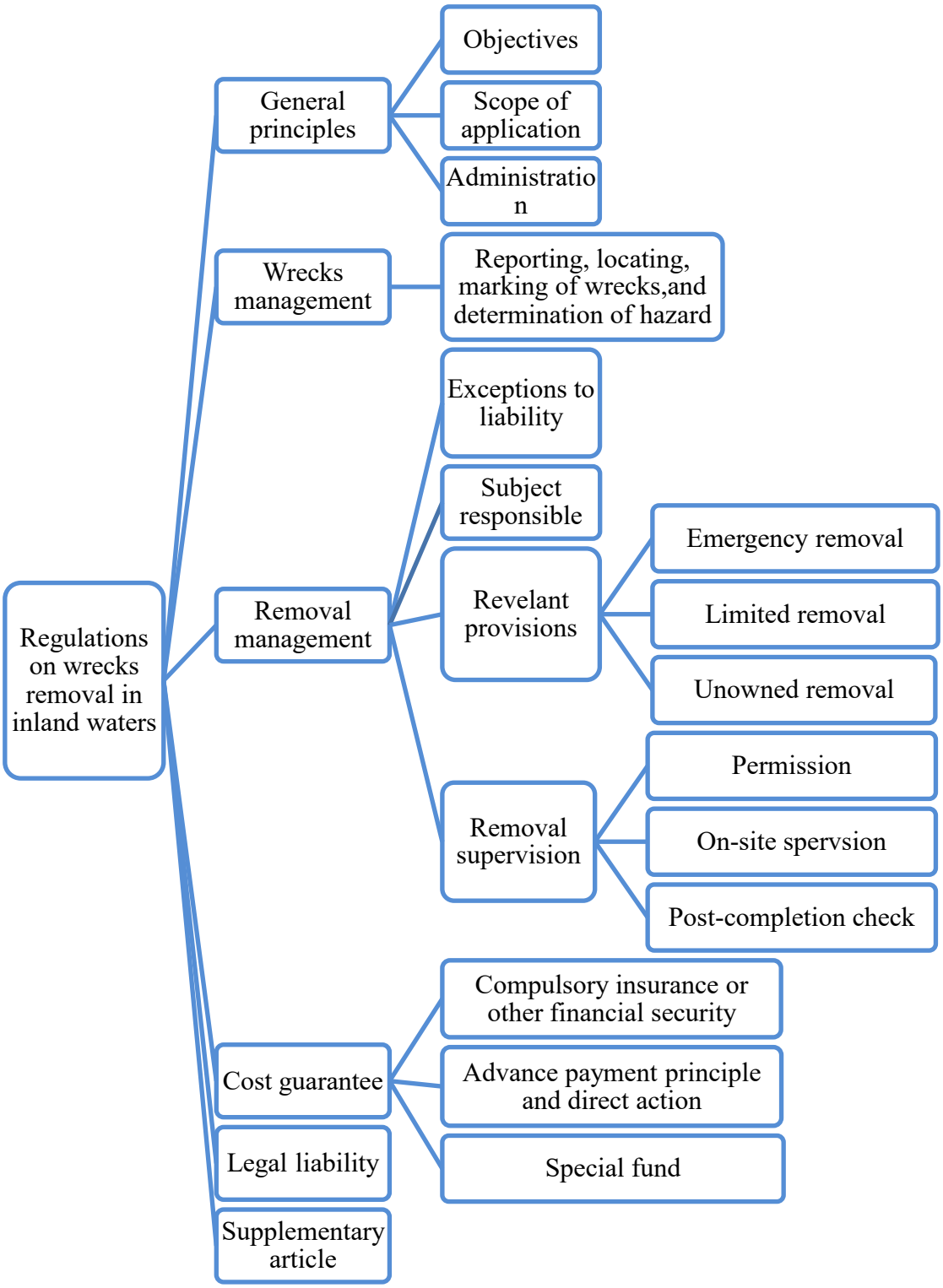


Figure - 9 Framework of regulations on wreck removal in inland water of China

CHAPTER 7

CONCLUSION

On the whole, the wreck removal mechanism in inland waters of China is still at a rough stage, at which the maritime administration in inland rivers is always in a dilemma situation on the problems of controlling responsible subject and pursuit of recovery on compulsory removal cost recovery. Different from the situation in ocean, the narrow waterway, the low quality ship condition, the poor obligation ability and the small number of regulations in inland waters result in more serious threats to the navigation safety and environmental protection. Therefore, revision of wrecks removal laws and regulations according to the practical situation, and improving wrecks removal mechanism is placed on the agenda.

According to the quantitative and qualitative analysis of AHP and SWOT, China should eliminate the weaknesses and seize the opportunity of external environment. To be specific, it should absorb the provisions in the Nairobi Convention and improvement experience of the oil compensation mechanism in China, and revise a complete, scientific regulation including both entity and procedure of wreck removal in inland waters. The new framework of the regulation should be mainly revised on defining the ship owners to be the responsible subject, establishing compulsory insurance and direct action system, and founding special fund for compulsory

removal.

Wreck removal in inland waters is a systematic project. It involves the maritime administration, the ship owner, the insurer, the salvage institution and other interest relationship, referring to complex legal issues, and there are many difficulties which need further study. Proceeding from the current problems and prominent contradiction, researchers should consider the status and changes of inland waterway transportation market maturely, and take the optimization of legal system as the main line to improve the wreck removal mechanism in inland waters of China.

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